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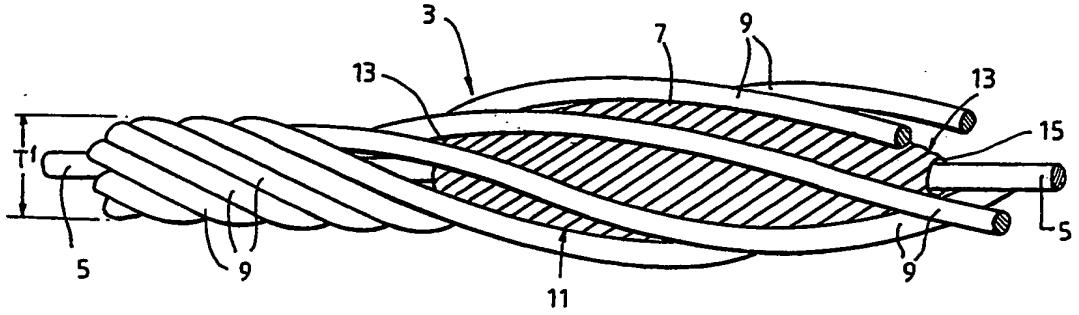

(57) Abstract

A cable bolt (3) comprises a central wire (5), a plurality of core members (7) positioned at spaced intervals along the length of the central wire (5), and a plurality of outer wires (9) wound around the central wire (5) and the spaced apart core members (7) so that the width of the cable bolt (3) is greater at the locations of the core members (7) than at the sections between the core members (7).

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CABLE BOLT

The present invention relates to a cable bolt for use in the ground stabilisation.

Cable bolts are used in a number of different applications in the mining and civil industries, such as for underground stoping, pillar support, development support and in open pit and civil applications where slope stabilisation is required. In general, cable bolts are used by drilling holes through potentially unstable ground into more solid strata into which the cable bolts are located securely by grouting.

In some situations, cable bolts are located to extend through the ore body to be mined and are at least partially exposed as the ore body around the cable bolts is removed by blasting. In other situations, cable bolts are located to extend through potentially unstable material which is not part of the ore body to be mined and, by stabilising the material, the cable bolts prevent such material mixing with the ore body to be mined and thereby increasing the volume to be processed and accordingly the costs of winning the valuable minerals.

A basic form of conventional hitherto widely-used cable bolt (hereinafter referred to as the "basic form of cable bolt") comprises a central wire and a plurality of outer wires (typically 6 or more) wound around the central wire in parallel spirals. The wires are usually formed from high tensile strength steel, and usually the cable bolt is stress relieved after it is formed.

The foregoing basic form of cable bolt has been found to have relatively low load transfer with the result that over time the mechanical interlock between cable bolt and grout is substantially reduced.

In order to improve the load transfer capability it is known to use a barrel and wedge assembly with the basic form of cable bolt. However, this has not proven to be altogether successful in terms of performance and also is a relatively expensive technique. It is also known to swage steel blocks at spaced intervals along the length of the basic form of cable bolt. Whilst this technique has proven to be successful in terms of improving load transfer, the costs are unacceptably high.

A further known approach to improve the load transfer capability is to modify the configuration of the basic form of cable bolt. The modified form, known as a "birdcage", comprises a plurality of enlarged diameter regions along the length of the cable bolt formed by selectively unwinding the cable bolt at the regions so that the wires can separate and bulge outwardly.

Whilst this technique is successful in terms of performance, the costs are relatively high. There are a number of factors which contribute to the relatively high costs, and one factor is the necessity to manufacture the cable bolt off-site in relatively short lengths which are difficult and costly to store and transport on-site.

In addition to the foregoing, many equipment manufacturers are now offering machines which are operable on-site to bore a hole for a cable bolt, cut a required length of cable bolt off a spool to suit the hole, locate the cable bolt in the hole, and grout the hole. This technology is being widely accepted by the mining industry as a means of improving efficiency. However, the basic form of cable bolt, and not the swaged and birdcage systems, is the only cable bolt which can be efficiently coiled into a spool and thus meets the criteria for the technology. However, against this, as is indicated above, the basic form of cable bolt is not altogether satisfactory

since it has a relatively low load transfer capability.

An object of the present invention is to provide a cable bolt which alleviates the disadvantages described in the preceding paragraphs.

According to the present invention there is provided a cable bolt comprising, a central wire, a plurality of core members positioned at spaced intervals along the length of the central wire, and a plurality of outer wires wound around the central wire and the spaced apart core members so that the width of the cable bolt is greater at the locations of the core members than at the sections between the core members.

The term "core member" is understood herein to include any member that increases the effective width of the central wire and, as a consequence, the effective width of the cable bolt at the location of the core member.

It is preferred that the central wire and the outer wire be formed from steel.

It is preferred that there be 6 or more outer wires.

It is preferred that the core member comprises a relatively wide middle section and relatively narrow ends and a central passage extending from end to end for receiving the central wire therethrough. It is preferred particularly that the core member tapers from the middle section to each end.

It is preferred that the core member be formed from a plurality of longitudinal sections which fit together around the central wire.

It is preferred that the core member be formed from substantially incompressible material.

It is preferred that the core member increase the diameter of the central wire by at least 20%.

According to the present invention there is also

provided a method of forming a cable bolt comprising, winding a plurality of outer wires around a central wire having a plurality of core members fitted to the central wire at spaced intervals along the length thereof.

It is preferred that the method further comprises coiling the cable bolt onto a spool.

According to the present invention there is provided a method of forming a cable bolt from a basic form of cable bolt comprising a central wire and a plurality of outer wires around the central wire, the method comprising radially displacing the outer wires from the central wire to form a space between the central wire and the outer wires, and fitting a core member to the central wire in the space.

It is preferred that the method further comprises repeating the radial displacement and core member placement steps to fit a plurality of the core members along the length of the central wire.

It is preferred that the method further comprises coiling the cable bolt onto a spool.

The present invention is described further with reference to the accompanying drawing which is a side elevation of a part of a preferred embodiment of a cable bolt of the present invention.

The preferred embodiment of the cable bolt 3 of the present invention shown in the drawing comprises a central steel wire 5, a plurality of core members 7 (only one of which is shown in the drawing) at spaced intervals along the length of the central wire 5, and a plurality of outer steel wires 9 wound around the central wire 5 and the spaced apart core members 7.

Each core member 7 is formed from substantially incompressible material such as steel and comprises a relatively wide middle section 11 and relatively narrow

ends 13 with a central passage 15 extending between the ends 13. Each core member 7 tapers from the middle section 11 to the ends 13 and is formed in 2 halves which (although not evident in the drawing) can conveniently be located together around the central wire 5.

The core members 7 cause the cable bolt 3 to have a variable thickness along the length thereof with a maximum thickness which is at least 20% greater than the minimum thickness T_1 of the cable bolt 3.

The effect of the core members 7 and the windings of the outer wires 9 around the core members 7 is that the cable bolt 3 has a similar load transfer capability to that of swaged cable bolts.

However, unlike swaged cable bolts, in accordance with a first preferred embodiment of a method of the present invention, the cable bolt 3 is manufactured with conventional technology used to form the basic form of cable bolt and thereafter coiled onto spools which can conveniently be stored and transported on-site. Specifically, the preferred embodiment comprises:

a) fitting core members at spaced intervals along the length of a central wire prior to wrapping outer wires onto the assembly of the central wire and core members, and then;

b) overwrapping outer wires onto the assembly of the central wire and core members.

In accordance with a second preferred embodiment of the method of the present invention, the cable bolt 3 is manufactured from the basic form of the cable bolt and thereafter coiled onto spools which can conveniently be stored and transported on-site. Specifically, the

preferred embodiment of the method comprises, repeatedly:

a) radially displacing the outer wires away from the central wire of the basic form of cable bolt to form a space between the outer wires and the central wire; and

b) fitting one of the core members to the central wire in the space.

The cable bolt 3 has the following characteristics.

a) A load transfer capability equal to or superior to that of swaged or birdcage cable bolts.

b) The stiffness of the cable bolt 3 can be varied by decoupling the cable bolt 3 from the grout along the length of the cable bolt between adjacent core members 7 or by varying the transverse thickness of the core members.

c) A capability of being coiled onto spools in lengths of hundreds of metres whereby, as a consequence, the cable bolt is not restricted to manufacture in relatively short lengths.

d) A compatibility with existing mechanical installation equipment.

Many modifications may be made to the preferred embodiment of the cable bolt described above without departing from the spirit and scope of the present invention.

By way of example, it is noted that, whilst in the preferred embodiment the core members 7 have a particular configuration, the present invention is not so limited and extends to any suitable configuration which has the effect of increasing the effective diameter of the central wire 5 and thereby the effective diameter of the cable bolt.

In this regard, one alternative configuration of core members 7 comprises lengths of wire wrapped around the central wire 5 at spaced intervals along the length of the central wire 5.

CLAIMS:

1. A cable bolt comprising, a central wire, a plurality of core members positioned at spaced intervals along the length of the central wire, and a plurality of outer wires wound around the central wire and the spaced apart core members so that the width of the cable bolt is greater at the locations of the core members than at the sections between the core members.

2. The cable bolt defined in claim 1, wherein the central wire and the outer wire are formed from steel.

3. The cable bolt defined in claim 1 or claim 2, comprising 6 or more outer wires.

4. The cable bolt defined in any one of the preceding claims, wherein the core member comprises a relatively wide middle section and relatively narrow ends and a central passage extending from end to end for receiving the central wire therethrough.

5. The cable bolt defined in claim 4, wherein the core member tapers from the middle section to each end.

6. The cable bolt defined in claim 4 or claim 5, wherein the core member is formed from a plurality of longitudinal sections which fit together around the central wire.

7. The cable bolt defined in any one of the preceding claims, wherein the core member is formed from substantially incompressible material.

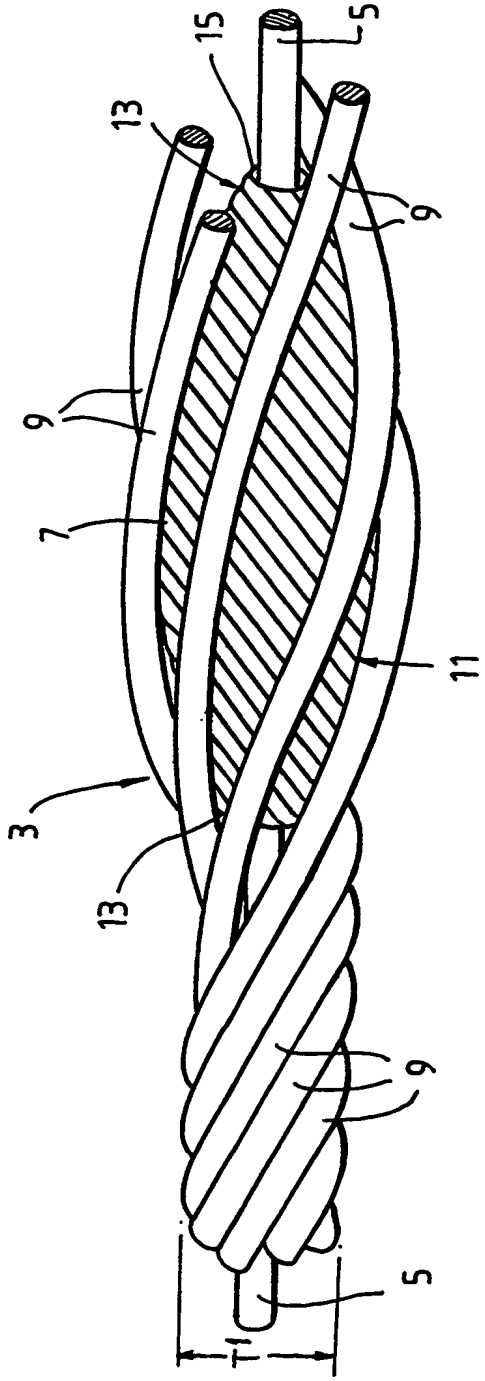
8. The cable bolt defined in any one of the preceding claims, wherein the core member increases the diameter of the central wire by at least 20%.

9. A method of forming a cable bolt comprising, winding a plurality of outer wires around a central wire having a plurality of core members fitted to the central wire at spaced intervals along the length thereof.

10. A method of forming a cable bolt from a basic form of cable bolt comprising a central wire and a plurality of outer wires around the central wire, the method comprising radially displacing the outer wires from the central wire to form a space between the central wire and the outer wires, and fitting a core member to the central wire in the space.

11. The method defined in claim 10, comprising repeating the radial displacement and core member placement steps to fit a plurality of the core members along the length of the central wire.

12. The method defined in any one of claims 9 to 11, further comprising coiling the cable bolt onto a spool.



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